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THESIS

**END-USER COMPUTING STRATEGY
IN THE
UNITED STATES MARINE CORPS**

by

Major John D. Myers USMC

March, 1990

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End-User Computing Strategy

in the

United States Marine Corps

by

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Major, United States Marine Corps

B.S., United States Naval Academy, 1976

Submitted in partial fulfillment

of the requirements for the degree of

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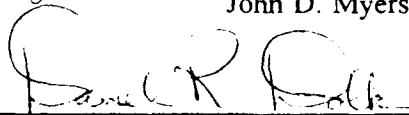
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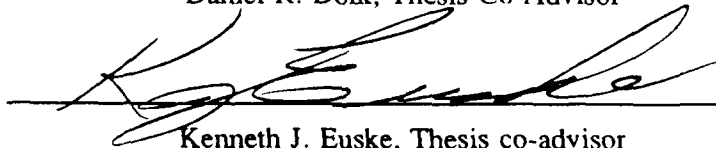


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ABSTRACT

The use of End-User Computing (EUC) in the Marine Corps has increased dramatically in recent years. As Marine Corps-sponsored programs progressed, large General Services Administration (GSA) contracts were established which made it relatively easy for government agencies to acquire microcomputers.

A strongly centralized strategy, successful in the management of the Marine Corps' mainframe systems, was adopted for the EUC program. This thesis concludes that the centralized strategy embraced by the Marine Corps is *inappropriate to contend with the* problems faced at the end-user level. End-users must be made an active part of the EUC process for lasting success. More importantly, current inadequacies in support and education must be addressed immediately to ensure effective use of the assets already procured.

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I. INTRODUCTION

A. BACKGROUND

Estimates have been made that End-User Computing (EUC) accounted for 40 percent of computer processing capacity in 1980, and will reach a projected 75 percent by 1990 (Brown, 1972, p.1). Additionally, the growth rate in EUC-related areas has been as much as five times higher than "conventional systems" (Gerrity and Rockart, 1986, p.25). The meaning of this drastic increase in EUC is that more and more people at all strata of organizations are becoming involved in computing. It's against this backdrop that the EUC effort in the United States Marine Corps is presented.

B. MOTIVATION TO INCREASE END-USER COMPUTING IN THE MARINE CORPS

The use of computer and data communications technology to manage information in support of the Marine Corps has increased exponentially in recent years (MCBul 5271, 1989, p.4-10). The Marine Corps in particular has much to gain from the efficient, effective use of automated data processing (ADP) throughout the organization. Traditionally the smallest force in the Department of Defense, the Marine Corps has a tradition of doing "more with less". Everyone must be capable of performing not only his or her job, but also that of fellow Marines. This applies to combat situations as well as the administrative area of the Marine Corps. Until a few years ago, the steady increase

in administrative requirements generated by upper echelons was causing a serious drain on training time for actual combat skills in Fleet Marine Force (FMF) units. A typical "reports required" list for a squadron would include monthly, quarterly, and annual reports to the squadron's parent group, aviation wing, and Fleet Marine Force (FMF) headquarters.

In late 1985, however, a concerted effort began at the highest levels in the Marine Corps to lessen the administrative burden in the FMF.

In recent efforts to reduce the administrative burden on the FMF, such as ALMAR 279/85 and ALMAR 177/86, the Commandant has emphasized the primacy of combat readiness. The Commandant stated "our most important peacetime objective is to achieve the combat capability to win any future battle. That objective must be emphasized by placing peacetime duties in proper perspective and ensuring that administrative functions are justified only to the degree that they contribute to FMF readiness." This emphasis on the primacy of combat readiness must be applied to the development of IS's that directly support the FMF. (MCBul 5271, 1989, p.4-10)

Such overt statements have helped to identify the role of ADP in the Marine Corps.

The question that remains, and which this thesis investigates is, "Has the intent of this ADP policy become a reality to the unit level Marines for whom it was intended?" As early as 1981, Marines were questioning whether computers were serving Marines, or vice versa (Anthony, 1981, p.18). Were these the grumblings of a few people resistant to change, or were they the beginning of deep-seated dissatisfaction with EUC in the FMF?

C. PURPOSE AND OBJECTIVES

The purpose of this thesis is to examine EUC in one segment of the Marine Corps. At a time when systems and applications are being designed for the end-user, there appears to be a lack of effort directed at examining the needs of those end-users who probably most require help but are least able to articulate that need. This thesis attempts to evaluate the effects of the Marine Corps' EUC strategy on the small unit. Current and future strategic planning are presented and evaluated from the standpoint of its impact on the small unit. Finally, recommendations are made to help foster and guide EUC at the small unit level. Three sources of information have been used in this study: (1) a literature search of planning models and analyses of EUC which were used to evaluate Marine Corps EUC strategies identified in the other two sources, (2) Marine Corps publications and documents, and (3), interviews with field units at the lower echelons.

1. Research Questions

The following questions guided the research approach of this thesis:

- What is the stated strategy for end-user computing development within the Marine Corps?
- Does the Marine Corps' main information resource management planning document (the Mid-Range Information Systems Plan) accurately depict the current EUC situation at the small unit level?
- Does the current Marine Corps EUC strategy provide for effective growth at the small unit level?
- How do current EUC conditions at the small unit level in the Marine Corps compare to models found in the literature?
- Is the current EUC organizational structure within the Marine Corps adequate to meet the needs of users throughout the Marine Corps?

- How are end-users at the small unit level trained and supported?
- How can users be better trained?
- What changes should be made in strategy (and) structure to facilitate effective EUC utilization in the Marine Corps?

D. SCOPE AND ANALYSIS LEVEL

End-User Computing (EUC) is a broad term, connoting many different levels of technology and user interaction. EUC can occur anywhere there is a person who has access to a computer (usually a personal or micro-computer). Bearing this in mind, the specific segment of analysis needs to be carefully defined. Figure 1 illustrates a matrix depicting two of the different factors which can affect EUC. Along one side lies the specific organization in which the analysis is to be performed. This recognizes the unique

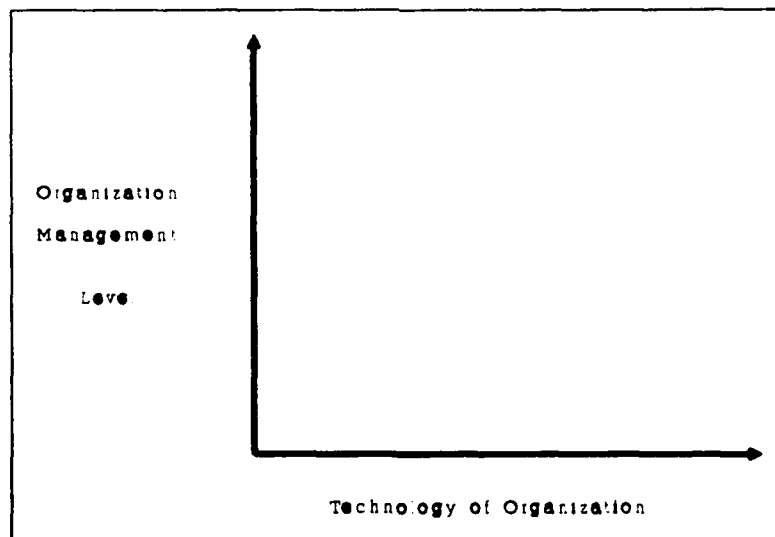


Figure 1. Factors Influencing EUC

effect of the organization relative to industry-wide EUC maturity. The second side of the matrix represents the organizational stratum. Different levels of an organization have different administrative and information requirements. These differences translate into a need for varied types of computer assistance.

Because of the vast size of the United States Marine Corps, this study will be more narrowly defined to focus on the squadron level of the aviation branch within the Marine Corps.

E. ASSUMPTIONS AND CONSTRAINTS

In specifying one tactical arm of the Marine Corps for detailed study, the potential information from other arms is being placed aside. The information vis a vis the aviation community is still extremely useful since it constitutes a major combat arm in the Marine Corps.

On-site interviews of Marines were limited due to the size of the project and operational commitments of the units involved. The primary means of interview was by telephone with written follow-ups. An exhaustive polling was not conducted, but representative units from two of the three Regular Marine Aircraft Wings were interviewed.

F. A WORKING DEFINITION OF END-USER COMPUTING

End-user computing will be defined in this thesis as an activity where an individual or group of users who are not data-processing professionals use computers (usually desktop microcomputers) for jobs, or applications, of their own design.

G. THESIS ORGANIZATION

The paper is presented in four main parts. In Chapter Two, EUC in the Marine Corps is described. An historical background of EUC is presented, followed by a description of the organization currently used in the Marine Corps. In Chapter Three theoretical models used to describe the growth and strategic implications of EUC are presented. Chapter Four presents the stated strategy of the Marine Corps towards EUC and places it within the frameworks of the theoretical models that were presented in Chapter Three. Analysis of the effectiveness of the Marine Corps' strategy is evaluated by using Marine Corps source material as well as interviews with end-users in the Marine Corps. These interviews come chiefly from those individuals from the Fleet Marine Forces, particularly at the squadron and Marine Aircraft Group (MAG) level. Chapter Five provides conclusions and recommendations.

II. END-USER COMPUTING ENVIRONMENT IN THE MARINE CORPS

A. INTRODUCTION

To be able to draw conclusions on EUC in the Marine Corps, the environment and framework must first be known. This chapter highlights the history of the factors influencing EUC in the Marine Corps, including contractual efforts to bring microcomputers into mainstream Marine Corps use. The background and development of two major projects, ADPE-FMF (the "Green Machine") project and its follow-on FMF-EUCE are traced. After the history, the framework upon which EUC rests in the Marine Corps is developed.

B. HISTORY

1. Initial Guidelines

In July of 1982 the Deputy Administrator of the General Services Administration (GSA) determined that the burgeoning personal computer population in the United States would bring untold management challenges. Consequently, he authorized a series of discussions, which resulted in a comprehensive document on the potential impact of EUC in the federal government, "Managing End-User Computing in the Federal Government." (GSA,1983,pp.i-ii)

a. *"Managing EUC in the Federal Government"*

"Managing End-User Computing in the Federal Government" is a far-sighted document, demonstrating that members of GSA recognized that vast changes were occurring in the way information resources were being utilized in all sectors. Overt choices needed to be made regarding EUC: either EUC could be ignored via moratoria on procurement of personal computers (in the hope that it would "go away"), or it could be addressed in a positive, proactive manner. The GSA report stated that the government should proceed "...with the knowledge at our disposal, however imperfect and whatever its limitations. We need to proceed and profit from our mistakes as the basis for better management decisions later." (GSA, 1983, p.3)

The paper highlighted the advantages of EUC, and also the challenges that it presented to all levels of management. Perhaps most importantly, however, the GSA document underscored the need for a strategic, proactive approach to end-user computing in the federal government. It made the leap from theoretical to practical by presenting a new program, called the "Managed Innovation Program." (GSA,1983,p.19) This program sought to advance EUC by performing two types of actions. The first type concerned direct management initiatives in cases where the problem was understood well enough that government-wide action could be taken. Planned action included developing a fact finding facility for GSA, developing a buyer's guide for personal computers, revising regulations and guidelines, and developing condensed procedures concerning ADP. As part of "streamlining the bureaucracy" in administration, personal computer procurement simplification was given a high priority.

GSA plans to implement a new approach for the acquisition of personal computers. The objective is to obtain discounts from aggregate purchases on a government-wide basis. In the spring of 1983, GSA will pilot test a schedule similar to the Teleprocessing Services Program (TSP) in which aggregate purchases are arranged with a number of microcomputer vendors and associated software suppliers. (GSA, 1983, p.21)

In the second type of action, the GSA report proposed to perform an end-user computer pilot project. Under this pilot project up to 50 personal computers would be obtained strictly for experimental purposes. As well as developing new applications, it was hoped that the project would provide insight into the type of management changes that would be required to effectively nurture EUC.

The impact of this paper upon Marine Corps attitudes toward EUC was substantial. Just over a year after the publication of the GSA document the Marine Corps presented its first draft publication of end-user computing guidelines. This document, the "United States Marine Corps End-User Computing Guidelines", acknowledged the impact of the GSA report when it stated "This recognition by GSA of general purpose microcomputers has led to the creation of a program known as End-User Computing (EUC) by both GSA and Department of Defense (DOD). (CMC 5230/CCIS-43,1984,p.1)

b. "Marine Corps End-User Computing Guidelines"

The draft proposal for Marine Corps EUC guidelines was published under the signature of Brigadier General P.D. Slack, the Director of the Marine Corps' C4 Systems Division. In his document he enthusiastically supported the concept of EUC to increase productivity "...by means other than hiring additional personnel." (CMC 5230/CCIS-43,1984,p.1) The tone of the document reflected its influence by the earlier

GSA publication. The overall goals and objectives of the EUC guidelines were to clarify management responsibilities and *initial policies* (emphasis by author), facilitate acquisition and use of EUC technology, prompt education efforts, and ensure that, as much as possible, EUC practices and programs complied with existing directives. The document then went on to provide general guidance in all areas of EUC, including planning, requirements documentation, acquisition, security, and education/training. Although the document was largely an empty "shell", it provided an architecture for further development that is remarkably consistent with current formats.

As a result of these two guidelines, the EUC program in the Marine Corps was definitely on its way. By October of 1984 the Marine Corps' ADPE-FMF project was almost three years old. ADPE-FMF, although it can scarcely be considered actual EUC, raised the consciousness of the average Marine about the existence of the personal computer. Under the contracts known as Desktop, the personal computer was almost literally dropped on every Marine's doorstep.

2. The Desktop Series Contracts

On October 3, 1983 the first of what turned out to be a series of contracts was signed between the United States Air Force Computer Acquisition Center (AFCAC) and Zenith Data Systems (Bridges, 1989). The Air Force contract provided the vehicle for all of the military services to purchase the Zenith Z-100/120 series microcomputer in a package, along with a selection of software. This contract was known as Desktop I. On October 2, 1984, The Z-150 microcomputer was provided on another segment of the contract (Bridges, 1989). This provided TEMPEST capability microcomputers. On

February 28, 1986 Desktop II was signed, again by the Air Force Computer Acquisition Center (Bridges, 1989). This contract provided for the Zenith Z-248 microcomputer, along with associated peripheral devices and system software. The Z-248 was an IBM-compatible microcomputer, equipped with an 80286 microprocessor. It used the popular MS-DOS operating system, as did its predecessors in Desktop I (McCarthy, (B), 1988, p.37). The initial estimate from the Air Force was that there would be 90,000 units sold under Desktop II (McCarthy, 1988, p.37). Desktop II proved to be hugely successful, and can be credited with bringing microcomputers to the squadron level. The unexpected success of Desktop II caused problems during the contract. On November 24, 1987 a moratorium was placed on new orders of Z-248 computers after it was discovered that total orders for the machine were already double the initial estimates (McCarthy, 1988, p.37). The contract was allowed to continue, however, until its planned expiration date in February 1989. Although Zenith Data Systems refuses to release sales figures for this contract (Bridges, 1989), estimates put the number of Z-248 machines acquired under Desktop II at 400,000 for the Department of Defense (Brewin and Danca, 1989, p.49). When the number of microcomputers obtained under the earlier Desktop I is considered, the total number of Zenith microcomputers owned by the Department of Defense approached 500,000 units (McCarthy (B), 1988, p.37).

In August 1988 the Air Force issued a request for proposals (RFP) for a follow-on, Desktop III contract (Reed, 1988, p.1). Having "opened the door" to personal computing with Desktop II, Desktop III was designed to bring more sophisticated computing power to the individual while maintaining continuity with already-existing

machines (Reed, 1988, p.49). The RFP for Desktop III called for two different machines. One would resemble the machine procured under Desktop II. A second, more advanced machine, based on the 80386SX microprocessor, would also be available. Both of the new machines would operate under the MS-DOS operating system as before, but would also be compatible with the UNIX operating system. (Reed, 1988, p.49) The RFP also required a wide variety of peripheral devices and software, including spreadsheets, word processors and data base managers for both machines (Reed, 1988, p.49).

Initial estimates forecast orders under Desktop III to be 200,000 to 250,000 machines, although Air Force spokesmen were quick to point out that this was only a rough estimate (Reed, 1988, p.1). Desktop III was initially planned to be implemented during the first calendar quarter of 1989, with the first deliveries to be made in April or May of 1989 (Reed, 1988, p.49).

In March 1989 International Technology Corporation, a small federal computer vendor, protested the Desktop III RFP, contending that its terms limited competition to manufacturers, large systems integrators, and particularly, the incumbent Zenith Data Systems (Brewin and Midford, 1989, p.1). As a result of the challenge, Desktop III was not brought into effect as early as originally hoped. To counteract the absence of an umbrella Desktop contract, both the Navy and the Army let smaller, interim contracts to allow for continued procurement of Zenith 248 or Zenith 248-compatible machines until Desktop III was signed (Palmer and Brewin, 1989, p.37).

In November 1989 Desktop III was awarded to Unisys Corporation (Brewin and Danca, 1989, p.1). Under the terms of the contract up to 250,000 machines would be delivered, worth an estimated 700 million dollars. Unisys based its bid on the use of its PW-2 line of microcomputers which 80286, 80386, and 80386SX microprocessors (Brewin and Danca, 1989, p.1). Zenith Data Systems immediately protested the selection of the Unisys machine, but withdrew its protest in early January 1990 (Robb, 1990, p.1).

At the same time that Desktop III was unveiled, the Navy revealed the results of the Standard Desktop Companion contract. Under this five-year contract Zenith Data Systems was to provide for software upgrades and hardware peripherals for the existing microcomputers obtained under the Desktop II contract (Smithmidford, 1989, p.1).

As a result of the Desktop series contracts and associated maintenance and upgrade contracts, the Marine Corps was catapulted into the information age at the small unit level. Although the Marine Corps received a small percentage of the total Zenith microcomputers acquired under Desktop, a platform had been established with which many Marines would become very familiar. Figure 2 summarizes the machines purchased under the Desktop contracts.

3. ADPE-FMF: The "Green Machine"

The Automated Data Processing Equipment for the Fleet Marine Force (ADPE-FMF), also known as the "Green Machine", was the first personal computer to find its way into the Fleet Marine Force at the squadron/battalion level and below. Although it will be shown that the predominate work on the Green Machine would not truly be

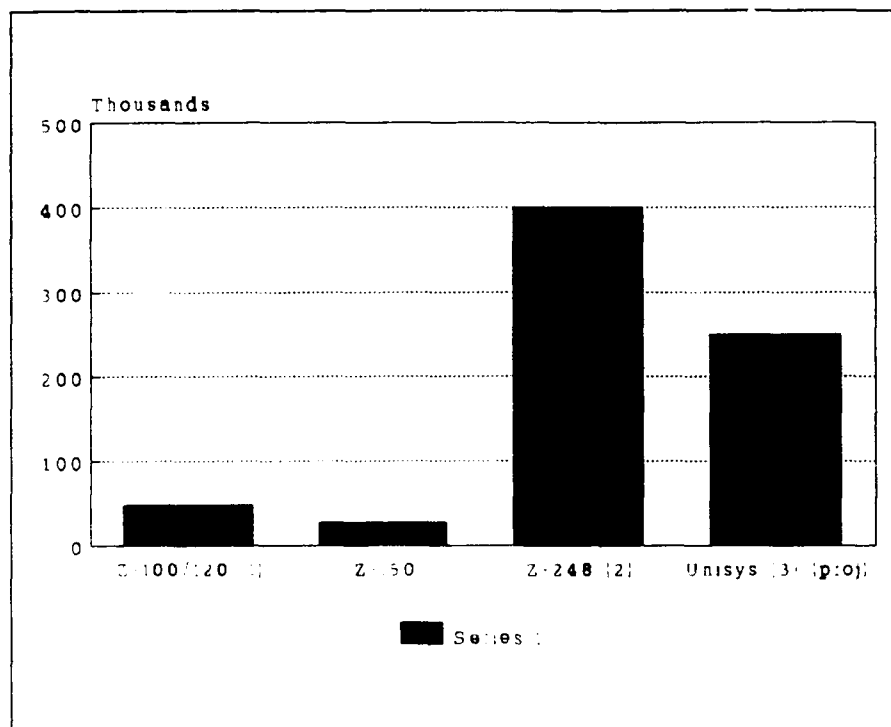


Figure 2. Desktop Contracts

classified as EUC, its introduction into the Fleet Marine Force was nevertheless a major milestone in the advancement of computer awareness in the mainstream Marine Corps.

a. Background

The Green Machine came as a result of a number of studies contracted by the Marine Corps beginning in 1974 (Aday and Pierce, 1982, p.19). The Marine Corps noted that the data collection effort to feed the major Automated Information Systems (AIS)'s maintained at the headquarters level was taxing the unit commanders. At the same time, the commanders' own information needs were not being met (Aday and Pierce, 1982, p.19). To avert a potential major problem, the Marine Corps looked at

various ways to gather the necessary information more quickly and efficiently. As a result the concept of Source Data Automation (SDA) was developed (Holste, 1984, p.30). Before SDA, data collection and entry involved multiple intermediate steps between the data source and its ultimate host computer. Efficiency, accuracy, and timeliness all suffered in systems that were initially touted to improve all three. The beauty of SDA was that it provided a direct connection between the data source and its host computer. The benefits of such a concept are obvious. In 1976 the Stanford Research Institute (SRI) performed what turned out to be a landmark study for the advancement of the SDA concept in the Marine Corps. In their study

SRI drew some conclusions regarding SDA in the FMF. Those conclusions were that the FMF units down to the battalion and squadron level had a requirement for an organic SDA capability. Additionally, the use of minicomputer and microcomputer technology was feasible at the lower command echelons. (Aday and Pierce, 1982, p.22)

In 1978 a Required Operational Capability (ROC) was developed and an economic analysis performed. It was decided that SDA devices should be provided to all elements of a Marine Air/Ground Task Force. The devices should be inexpensive, easily deployable, must utilize commercial off-the-shelf equipment, and should be able to be operated by non-technical personnel. They were required to support five major functional areas: pay and manpower, supply, maintenance, aviation, and training. A contract was awarded to IBM for SDA equipment on March 1, 1980 which became the ADPE-FMF contract (Aday and Pierce, 1982, p.24). Initial implementation of the Green Machine was completed on the West Coast during 1981, with implementation for the rest of the FMF occurring within 18 months (Aday and Pierce, 1982, p.14, Fresquez, 1981, p.17).

b. Description

The Green Machine was an IBM 4110 mini-computer with commercially-available, off-the-shelf data processing equipment which had been "ruggedized" and packaged to meet Marine Corps requirements. The Central Processing Unit had a memory size of 64 kilobytes, expandable to 128 Kbytes. Two disk drives were provided which accommodated the eight inch diskettes. No hard drive was installed. A video display and keyboard was integral to the Green Machine. A terminal printer, provided with all machines, enabled the unit to retain a local copy of the data which had been submitted, and to print local reports. (Aday and Pierce, 1982, p.30) Finally, each Green Machine contained an integral modem capable of providing asynchronous communications over the spectrum of 75 to 1200 bits per second (Aday and Pierce, 1982, p.31).

In addition to the standard equipment described above, special equipment was provided to units which were deploying or had special requirements. A magnetic tape drive unit capable of reading and writing magnetic tapes was provided to some units. A paper tape punch was provided to all units embarked aboard Navy ships which was capable of punching five-level paper tape at a minimum of 75 bits per second. The paper tape would then be delivered to the ship's communication center, where it would be sent back to the United States for processing. (Aday and Pierce, 1982, p.32)

Some of the Green Machine's software features seem primitive eight years later, but at the time they were state of the art. For example, it had only 40 Kbytes available for applications after the operating system was installed. This seems incredibly small, but it was, nevertheless, sufficient at the time. Other features of the Green

Machine included the ability to be programmed in low and intermediate level COBOL. This illustrates its potential as a device capable of running local applications. The Green Machine provided a great deal of help to the user. In addition to numerous "help" features, it also provided fully prompted interactive editing of input data and possessed self-test diagnostic programs to isolate hardware faults (Aday and Pierce, 1982, p.42). Thus it was truly a machine designed to be as simple as possible, and still allow for efficient data capture.

c. Applications

The Green Machine was designed primarily as a SDA device for input to Marine Corps Class I Automated Information Systems (AISs). This classification system is composed of four classes of AISs which are categorized by the degree of flexibility in operations permitted FMF commanders. A Class I system is one which is processed on a mainframe computer, serves Marine Corps-wide users, and is under the technical control of a contractor of a Marine Corps Central Data Processing Activity (Aday and Pierce, 1982, p.37). It is the largest and most comprehensive system AIS. The Green Machine was designed to support 14 Class I applications. Those applications are listed in Table 1 (Aday and Pierce, 1982, p.24).

The following estimate was made as to the time requirements for Class I data submission.

It is estimated that approximately six to seven hours per day will be required just to complete Class I inputs...Priorities will have to be established and monitored by each unit. To get maximum return from these devices, it is evident that they will have to be used beyond the standard eight-hour day. (Fresquez, 1981, p.17)

TABLE 1. FMF-ADPE CLASS I APPLICATIONS

AVIATION	Flight Readiness Evaluation Data (FREDS) Maintenance and Materiel Management (3-M)
MANPOWER	Unit Diary/Commander's Unit Diary Data Base (UD/CUDDDB)
FISCAL	Allotment and Bond (ABA) Transcript of Data Extraction (TODES) Payment Option Election System (POES) Disbursing Officer's Voucher (DOV) Military Pay List (MPL) Military Pay Voucher (MPV) Marine Air/Ground Financial Accounting and Reporting System (MAGFARS)
LOGISTICS	Supported Activities Supply System (SASSY) Marine Corps Integrated Maintenance Management System (MIMMS)
OPERATIONS	Marine Corps Combat Readiness Evaluation System Software Application (MCCRESSA)
COMMUNICATIONS	Message Editing and Processing System (MEPS)

In addition to the Class I requirements for the Green Machine, local commanders were given the option to develop "Class IV" applications for local use. A Class IV application is under the functional control of an FMF unit, with technical responsibility assigned to an Information Systems Management Officer (ISMO). A Class IV application is processed exclusively on local minicomputers for local use (Aday and Pierce, 1982, p.38).

The system of using Class IV applications was designed to give the local units the opportunity to tailor their machine to meet individual requirements. Unit members could scan application libraries maintained by local ISMO's, or could use in-house resources to provide their own applications (Holste, 1984, p.31). Aday and Pierce provided a recommended set of checklists to use to ensure an orderly development process when developing local applications. These guidelines specified the development model to be utilized in analyzing requirements, designing the application, and writing the code. They also specified the documentation requirements, up to and including a User's Manual and a Data Dictionary description of the elements in the application (Aday and Pierce, 1982, pp.112-124). Once the application was developed, debugged, and approved (by the local commanding officer) copies of the application would be provided to the local ISMO for inclusion into his application library.

d. Results

The Green Machine was a total success in its role as a SDA device. The most popular measure of effectiveness for the Green Machine was the Unit Diary, which contains crucial manpower and pay-related information for the local unit. Acceptance rates (the measure used for the percentage of syntactically correct and properly formatted data) for West Coast units using the Green Machine showed immediate improvements of from 2.6 percent to 5.4 percent while showing error rate decreases ranging from 38.2 to 72.6 percent (Aday and Pierce, 1982, p.44). Similar benefits were recorded in other Class I applications, particularly in the Marine Integrated Maintenance Management System

(MIMMS), the Supported Activities Supply System (SASSY), and the Flight Readiness Evaluation Data Systems (FREDS) (Holste, 1984, p.30).

There were, however, "bugs" in the implementation and management of the Green Machine. Many units felt that they had been left to their own devices with respect to training on the Green Machine. Although IBM was contractually obligated to provide initial training, the training that they provided was to higher level personnel in Class I application areas. Actual user training was delegated to FMF commanders (Aday and Pierce, 1982, p.56). In addition to the confusion felt regarding the machine, users interviewed by Aday and Pierce felt that there was too much tasking from above involving use of the Green Machine. In an already-tight schedule, many higher echelons created additional ADP requirements, thus eliminating any chance of the squadron commander using the machine for local applications. (Aday and Pierce, 1982, p.53)

Thus began the relationship between the computer and the FMF unit. The Green Machine became an integral part of every Marine Corps squadron, and greatly aided in the transition toward a more computer-aware Marine Corps. In August 1988 replacement of the 842 Green Machines with new machines began. The new machines were developed under the Fleet Marine Force-End User Computing Equipment (EUCE-FMF) Program. (MCBul 5271, 1989, p.5-8)

4. FMF-EUCE

a. Background

Between the adoption of the Green Machine and the acquisition of Zenith microcomputers obtained under (primarily) Desktop II, the Marine Corps learned much about bringing data processing to the squadron/battalion level. A de facto standard had been reached with the Zenith-series microcomputers. These computers illustrated the advances that had been made since the advent of ADPE-FMF, such as increased processor speed, increased primary and secondary memory, and ease of use. FMF commanders felt that the Zenith computers were good, but that future computers must be "ruggedized" for use in a deployed environment. Further, they insisted that the successor to the Green Machine must be compatible with the Zenith-series computers. (IRM-5230-01,1989,p.1) With these factors in mind, a successor was sought for the Green Machine. Selection was made and fielding began in August 1988 (MCBul 5271,1989,p.5-8).

b. Description and Concept of Operations

The FMF-EUCE (designated AN/UYK-83 by the Marine Corps) machine is an enhanced version of the ITT XTRA/286 microcomputer. It was re-engineered to provide the capacity to withstand environmental extremes required by FMF commanders. It uses an 80286 microprocessor, with an 80287 Arithmetic Coprocessor installed. The system is provided with two megabytes of main memory, with two 40 megabyte removable hard drives installed. Provided also are an EGA color monitor, dot matrix

printer with OCR font, and a detachable keyboard. Environmental protection is provided via a hard transport case, and a surge protector. (MCBul 5271,1989,p.5-9)

Conversion from the ADPE-FMF to the new FMF-EUCE was planned to be evolutionary, with training on the new machine integrated into formal schools for new personnel and limited contractual training/on-the-job training for Marines already in the field (MCBul 5271,1989,p.5-9). Virtually all other aspects of employment have remained unchanged from the original Green Machine.

C. MARINE CORPS ORGANIZATION FOR END-USER COMPUTING

With the advent of the Green Machine, it was recognized that FMF units needed special assistance with their now-organic ADP assets. Accordingly, a framework was developed to augment the existing ADP support structure. This structure has not changed since the beginning of the EUC revolution in the Marine Corps. For purposes of discussion, the two parts of the framework closest to the actual end-user will be discussed below. They are the Information Systems Management Officer (ISMO) and the Information Systems Coordinator (ISC).

1. The Information Systems Management Officer

The Information Systems Management Officer (ISMO) is the primary staff officer for information resource matters within a major (i.e., Wing) FMF command. The Mid-Range Information Systems Plan defines his duties:

The ISMO is the primary staff officer for information resource matters within an FMF or Supporting Establishment command. The ISMO's functions include: (1)

Advising the commander and the staff on information technology matters. (2) Acting as command focal point on all matters pertaining to coordination of information technology requirements, objectives, concepts, plans, and policies, including establishing priorities with supporting and external data processing activities. (3) Exercising staff supervision of organic data processing units and equipment. (4) Preparing IRM support estimates, operating and contingency plans, and ensuring that these plans are tested. (MCBul 5271, 1989, p.3-7)

In short, the ISMO is expected to provide guidance and education to the FMF (and the Supporting Establishment) in using not only organic Green Machine assets, but also in the use of any other ADP equipment in the organization.

Further, the ISMO:

...seeks technical assistance from the units supporting RASC or MCCDPA. He/she translates user requests into terms more familiar to the data processing personnel in these activities. (Leblanc, 1989, p.61)

There are 22 of these ISMO organizations throughout the Marine Corps, located at the various Headquarters (Leblanc, 1989, p.60). The size of the ISMO units varies anywhere from one officer and two enlisted Marines to 13 officers and 89 enlisted Marines. The size is dependant upon the warfare specialty of the particular unit. Force Service Support Groups rate the highest number of personnel because of their large number of ADP activities. The Infantry Division, on the other hand, is entitled to one officer and two enlisted Marines. The Marine Aircraft Wing is entitled to two officers and five enlisted Marines. (MCBul 5271, 1989, p.4-5) Beside the number of personnel in the ISMO, their geographic span of control is also important. Some ISMOs, such as that of the Second

Marine Division at Camp Lejeune, have virtually all of their supported units within the gates of the base. Other ISMO centers cover far more vast areas. The Second Marine Aircraft Wing ISMO, for example, is responsible not only for assets at Marine Corps Air Station (MCAS) Cherry Point in Havelock, North Carolina, but also for MCAS New River in Jacksonville, North Carolina, and MCAS Beaufort in South Carolina.

The ISMO performs two major duties. The first duty is as a staff officer to advise his Commanding General of ADP matters. His second area of responsibility is as an educator to the units which the ISMO nominally supports. Leblanc sees this role as closely resembling that of a formal Information Center (Leblanc, 1988, p.60).

2. The Information Systems Coordinator

The Information Systems Coordinator (ISC) is the individual closest to the user in a Marine Corps unit. This billet is designed to serve as the unit's point of contact (with the ISMO) for ADP activities, to provide unit training and to provide assistance whenever possible (Leblanc, 1988, p.61). At least at the squadron level, the ISC is a collateral duty involving little or no training (Thombs, 1990). At the group level there is still little or no formal training involved, but the responsibilities become greater. Group ISCs administer machines throughout the group, advise the group commanding officer of ADP requirements, and serve as the primary point of contact for squadron users (Molen, 1990).

D. SUMMARY

This chapter presented a brief overview of end-user computing in the Marine Corps. The first computers in the small unit level of the Marine Corps were the Green Machines, IBM 4110 minicomputers that were introduced to automate source data capture. They also provided and continue to provide the unit commander with a limited ability to generate reports and rosters from a large database.

In June 1983 the General Services Administration published a landmark document "Managing End User Computing in the Federal Government". This work urged federal managers to adopt a proactive strategy for EUC growth in all areas of the federal government. In addition to providing theoretical impetus, it provided practical guidance on EUC growth and illustrated the GSA's intention of streamlining microcomputer acquisition for lower-level management. This document led to the Marine Corps' first guidelines on EUC published in October of 1984.

A series of contracts with Zenith Data Systems has provided the Department of Defense with over 500,000 Zenith microcomputers. The Desktop contracts were originally engineered by the Air Force, but in a way that enabled the other services to purchase these microcomputers as well. Desktop II expired in February 1989 and a follow-on was scheduled to begin immediately afterward. There was a great deal of difficulty arriving at a winner for Desktop III. Although Unisys was awarded the contract in November 1989, protests have been filed by other competitors which were eventually dropped.

A framework was developed for providing EUC support at the small unit level during the implementation of the Green Machine. The Information Systems Management Officer (ISMO) is a general staff officer whose responsibility it is to supervise ADP employment, training, and acquisition within his particular unit. His office is staffed with anywhere from three to 92 Marines, depending on the nature of his unit. His point of contact at the small unit level is the Information Systems Coordinator (ISC), an officer or enlisted Marine who fills the billet as a collateral duty.

III. END-USER COMPUTING STRATEGY MODELS

A. INTRODUCTION

Because of its enormous impact on virtually all aspects of society, there has been a great deal of examination of the EUC phenomenon over the past few years. This chapter examines some of the research which has been performed in an attempt to understand EUC. Some of the important attributes of a meaningful EUC model are illustrated, followed by a motivation for the necessity of an overall strategy for EUC growth management. Four of the models which have been used to analyze the EUC revolution are discussed.

B. NECESSARY MODEL ATTRIBUTES

In an area where rapid change is occurring, two pieces of information are vital. First, the manager must know where his organization is located in respect to a well-defined continuum. The second piece of information is a logical outgrowth of the first: the manager must have a target at which to aim his organization. It is vital that these actions be performed overtly in an area as complicated and nebulous as EUC.

To effectively help the planner, EUC models must be *descriptive* so that the individual may accurately identify the location of his organization. An EUC model must also *present a continuum* of states in which an organization can be located. Finally, the model must be *prescriptive*. There will undoubtedly be many paths to take for any

particular organization. The ideal model should identify the advantages and disadvantages of a particular course of action for each particular (or at least general category of) organization. This will help the individual choose a rational "target" and migration path for his organization.

C. IMPORTANCE OF A PREDEFINED STRATEGY

The importance of an overall strategy to an organization has been substantially documented. A strategic outlook enables the manager to determine a direction for his organization to move. It will be shown that the need for a predefined strategy has been late in coming to the EUC environment. Management did not "invent" EUC. Rather, end-user computing, by definition, grew from the ground up. However, over a period of time it has evolved from a homegrown phenomenon to a resource large enough to both dramatically help or hinder an organization. As early as 1983 Rockart and Flannery discussed the need for an end-user strategy in organizations:

Little attention has been paid to the development of a strategy for end-user computing either in the organizations we studied or in the perhaps two dozen organizations with which we have discussed these findings since the study...If one believes: (1) that end-user computing will reach 50-70 percent of the MIPS in almost every corporation in the next several years; (2) that end-user oriented "information databases" have increasingly become an integral part of the working environment of major corporate staffs; and (3) that rapid change in the tools and techniques available in this area require guidance--then, the lack of a strategy and a clear long-range plan in this area is a serious mistake for the I/S function. (Rockart and Flannery, 1983, p.778)

The importance of a model which provides for an EUC strategy becomes more clear. Four models will now be examined which show different ways of defining the

EUC environment. Each has a different specific strategic direction. In all but one, the models are comprehensive to all aspects of a strategy. The final model, developed by Euske and Dolk, addresses control of EUC, a subset of a strategy. It is presented because of its similarity and applicability to an entire strategy.

D. ALAVI, NELSON, AND WEISS'S END-USER COMPUTING STRATEGY FRAMEWORK

Alavi, Nelson, and Weiss believe that organizational computing is currently in a state of flux because of end-user computing (Alavi, Nelson and Weiss, 1987-88, p.28).

They urge all organizations to evaluate themselves regarding end-user computing:

If a shift is occurring which imposes significantly greater expectations on end-users, then the organization must develop a strategy to ensure that these expectations are realized...Development of an effective end-user computing strategy may be the most important short-term decision the organization can make if it hopes to benefit from its investments in end-user-based technologies. (Alavi, Nelson, and Weiss, 1987-88, p.29)

Alavi et al. work toward two goals: the development of a set of EUC strategies and the design of a framework, or timetable, for their implementation within an organization. They identify five categories commonly identified in the literature: Laissez-faire, Monopolist, Acceleration, Marketing, and Operations-based. These strategies are evaluated along three dimensions of EUC management: **policy setting and planning, support, and control.** (Alavi, Nelson, and Weiss, 1987-88, p.30) Policy setting identifies appropriate and acceptable EUC practices. Planning, on the other hand, refers to the identification of goals and objectives, and the establishment of a framework for utilizing resources. EUC support refers to tools and training which enhance EUC capabilities

within the organization. Control refers to the processes which are set in place to ensure that policies are complied with and that goals are met. (Alavi, Nelson, and Weiss, 1987-88, p.33)

1 Laissez-faire Strategy

A Laissez-faire strategy is, essentially, no strategy other than a tacit acknowledgement of EUC in the organization. No organizational policies are provided regarding standards, acquisition tools, or data management. EUC activities are unplanned. Support for end-users is provided solely by local "experts", self-trained individuals who have become proficient in an area of expertise. There are no controls placed on the individuals, but access to corporate database is denied to end-users.

The Laissez-faire strategy can be viewed in two ways. First, it can be viewed as an "entry level" strategy. In this sense it is assumed that there is some interest from management in the outcome of EUC in the organization. However, the onus is placed entirely on the users. This is called "wait and see" by the authors, but is actually closer to "sink or swim". The other view of Laissez-faire is that it is not so much a strategy as it is a condition in an organization. In this situation there is no active thought regarding EUC by management.

2. Monopolist Strategy

The Monopolist strategy is diametrically opposed to the Laissez-faire strategy. "The policy setting and planning, support, and control dimensions in a Monopolist

strategy are geared to restricting EUC activities." (Alavi, Nelson, and Weiss, 1987-88, p.37) This strategy is concerned primarily with efficient and cost-justified applications of computer technology.

Policy setting in this environment is tightly structured. Virtually all aspects of the EUC environment are regulated, often by the Management Information System (MIS)/Data Processing (DP) Department. Very strict standards are enacted and enforced. Little planning is required, since the highly-structured environment precludes the need for planning. Training that is provided is usually ad hoc and infrequent. As in the Laissez-faire strategy, access to the corporate databases is denied to end-users. As can be imagined, control under the Monopolist strategy is very high. Many control mechanisms are put in place, such as chargeback systems, development and operational controls, and/or audit and review teams. (Alavi, Nelson, and Weiss, 1987-88, p.38)

3. Acceleration Strategy

The Acceleration strategy is almost exactly the opposite of the Monopolist strategy. Whereas the growth of EUC is intentionally stifled under the Monopolist strategy, in the Acceleration strategy enthusiasm toward EUC is actively sought. "The acceleration strategy is based on a philosophy of 'the user knows best.'" (Alavi, Nelson, and Weiss, 1987-88, p.38)

Typically the Acceleration strategy is administered through the use of an Information Center (IC). Here users are given support and education by a trained staff, based upon the expressed needs of the users. Policy closely resembles that of the Laissez-faire strategy: there is little formal or restrictive policy. Planning is largely

reactive, based upon the actual situation, not the desired situation. Support in an Acceleration strategy is very strong. End-users get frequent and timely support through the IC. Since the support is generated by their own requests and not corporate policy, the direction of EUC in an organization is largely uncharted. Although IC's have the potential for molding EUC to meet corporate guidelines, this is not the case in an Acceleration strategy. Control is limited in an Acceleration strategy. There may be mechanisms that resemble those employed in a Monopolist strategy; for example, a policy of reviewing EUC acquisition requests, but the Acceleration strategy looks at this review as a means of enhancing quality whereas the Monopolist strategy views it as a way to restrict acquisition.

4. Marketing Strategy

Of the strategies discussed so far, the Marketing strategy is the most proactive toward the development of EUC in the organization. Under the Marketing strategy, the organization has a firm idea of where it desires EUC to progress. It seeks to increase EUC use, but *the increase will be in consonance with organizational goals.*

The policies and plans under the Marketing strategy are more formal. Standards exist and are enforced, but the emphasis is on leading end-users to the standards by means of advertising, support, and value-added products.

Support for end-users is necessarily extensive. The support organization consists of two levels. The centralized MIS/DP department provides overall guidance by providing technical support and ensuring that the direction sought by end-users coincides with corporate goals. The decentralized support groups provide the interface to the end-

users themselves. These groups answer day-to-day questions and support locally-generated applications development. Questions that they are unable to answer are referred to the MIS/DP department for further clarification. The emphasis placed upon Control under the Marketing strategy is to direct end-users toward the goals of the organization. This is done partially by the use of the standards described above. Rather than "hitting walls" as in the Monopolist strategy, end-users are "deflected" and guided forward.

5. The Operations-based Strategy

The fifth strategy discussed is called Operations-based. This is the most integrative, mature strategy involving EUC in the organization. In this environment the information generated by EUC has risen to the level of importance achieved by traditional Automated Information Systems. All aspects of EUC are scrutinized and controlled to benefit the organization directly. Standalone units are linked into local area networks. There is a high degree of interconnectivity between all departments in the organization.

The planning involved in the Operations-based strategy is extensive. There is no more "EUC for EUC's sake". There is a high degree of computer literacy throughout the organization. Policies are designed to efficiently utilize all EUC assets, and hence are tightly structured.

Support under an Operations-based strategy is available, but is generally more sophisticated due to the sophistication of the end-users. The emphasis again is on efficiency, and also of utilizing and integrating EUC with sophisticated corporate ADP assets such as corporate databases.

Control under an Operations-based strategy is extremely high. Since end-users are permitted access to virtually all of the information vital to the organization, there must be checks to ensure that compliance with established guidelines is maintained. Also, the emphasis on efficiency must be reinforced by control measures. Chargeback systems, where access or equipment time is charged against a department's budget, is an example of the type of control utilized under an Operations-based strategy.

6. Guidelines for Adoption of EUC Strategies

The underlying assumption made by Alavi et al. is that the strategies described are almost all appropriate at some time in an organization's level of EUC development. The trick, then, is to determine which strategy is appropriate when, and which strategies are not appropriate at all to the organization. They used a premise developed by McFarlan and McKenney (1983) as a framework for development of a "timetable". McFarlan and McKenney believed that there is a "learning curve" in every organization regarding EUC. They classified stages of this learning curve into five main areas to which Alavi, Nelson, and Weiss add an additional phase (Alavi, Nelson, and Weiss, 1987-88, p.41).

a. Pre-Strategy phase

In this phase there is only an unconscious attitude relating to EUC in an organization. There is a growing perception that people are using their own computing assets, but the organizational ramifications have not been explicitly developed. This

phase will lead to one of two possible outcomes. Either the organization will realize the benefits of EUC to the organization and proceed with an integration plan, or EUC will be left to its own devices.

b. Phase 0

Phase 0 is the phase that Alavi, Nelson, and Weiss have introduced to the model. This phase is similar to the Pre-strategy phase in that it represents initial attitudes on the part of the organization. Unlike the Pre-strategy phase, however, Phase 0 shows an explicit realization that EUC is a force with which to be reckoned. This will lead to one of two paths. If the organization is excited about the possibilities presented by EUC, a Laissez-faire strategy will be taken. This is indicative of a plan with a great deal of enthusiasm but little planning. The alternative course of action is the adoption of a Monopolist strategy. This strategy will be adopted early to hold EUC in place until the organization can more fully evaluate its impact, and prepare for its arrival.

Phase 0 seems to be the most transitory of the phases. Each of the strategies that occur in Phase 0 present inefficiencies and dissatisfaction that are addressed in Phase I.

c. Phase I

Regardless of the initial strategy taken, either Laissez-faire or Monopolist, Phase I is characterized by the realization that EUC can play an important role in the function of the organization, and that it should be developed more fully. Phase I sees the adoption of an Acceleration strategy. Control is still kept to a minimum; plans and

policies are general and product-oriented. Support during this phase becomes more formalized; the local expert relied upon in Phase 0 is augmented or supplanted by more formal support structures, such as the Information Center.

The chief indicator of the maturity of this phase is the demand for technology and support noted in the organization. At some point the organization must make an assessment of its EUC maturity, and think of its end-users as a customer base in and of itself. At this time a strategy of *directed* growth is needed.

d. Phase II

The need for directed growth noted at the conclusion of Phase I leads to a Marketing strategy in Phase II. In this phase the organization has a better idea of which direction it wants EUC to take, so planning becomes more complete. Those plans are implemented by the addition of a central planning and policy structure to guide the support facilities. This enables the organization to shape the direction of growth in a positive, proactive manner. If these methods do not provide the necessary direction, controls may have to be added to supplement the support structures. A reversion to uncontrolled growth could damage the organization at this time since EUC has, by now, penetrated the organization to a high degree.

e. Phase III

The authors introduce a new strategy in Phase III which they call Containment. They call it a strategy for lack of a better word; actually this phase is a "breathing spell" in the progression of EUC growth. The purpose of this phase is to let

the organization digest and assimilate the rapid change made throughout the past three phases. Progress is not stifled, as in the Monopolist strategy, but rather the emphasis is placed on lateral growth. There is potential for reversion to a Monopolist strategy, however, if this phase is kept in place for a period of time. Controls are necessarily tightened; if corresponding progress is not made, user dissatisfaction could start to appear. Prior to this, the last phase should be entered.

f. Phase IV

Phase IV represents the mature organization with regard to EUC. This phase is characterized by the adoption of the Operations-based strategy. In this phase EUC is not an end, but rather another effective tool to effectively pursue the organization's strategic aims.

The Operations-based strategy adopted in Phase IV seeks to tie up all the loose ends and connect the individual departments into an integrated information-sharing facility. Local area networks (LANs) and software libraries appear to provide a commonality with which to implement inter-department activities.

7. Conclusions

Both Alavi et al. and McFarlan and McKenney arrive at conclusions regarding EUC growth. They believe that there is a definite progression through a series of reasonably well-defined stages. They feel that the stages are all important to the

successful development of EUC in the organization. These stages may be abbreviated or lengthened, but *they should not be skipped*. Further, the authors feel that these stages can be planned for and anticipated.

E. HUFF, MUNRO, MARTIN, AND MOORE

Two articles have been written which both advance and challenge the theories presented by Alavi, Nelson, and Weiss. Huff, Munro, and Martin (1988) present an entirely new concept in gauging EUC maturity within an organization. Huff, Munro, and Moore (1987-8) complement this article, by providing a proactive framework for navigation through the various strategies suggested earlier.

1. The Applications Maturity Metric

Martin et al. point out that EUC maturity in microcosm is continuously changing within an organization of any size. At any given time there is a huge diversity in experience, expertise and capabilities among end-users. Rather than take an "average" of the end-user capabilities within an organization, results which are more meaningful than simply deriving an aggregate expertise level are sought. The means that they use to evaluate EUC maturity in organizations is the applications that have been developed for use by the end-users. Although some applications are bound to be too sophisticated for the average user at any given time, the steady progression in application development is, they feel, indicative of the overall corporate EUC maturity level. Martin et al. have identified five main stages of application maturity within an organization.

a. *Isolation Stage*

In this preliminary stage, EUC is in an experimental phase within the organization. The level of applications dependence by the individual in the course of his daily work is minimal. The end-user is "getting the feel" of things for later development.

b. *Standulone Stage*

In this stage the end-user has become proficient in the use of his ADP equipment in some aspects of his daily routine. He has often developed his own simple applications. His work is not compatible with that of the organization, but it is meaningful for him. All data entry is entered manually by the end-user.

c. *Manual Integration Stage*

By the time the Manual Integration Stage is reached, the applications that have been developed are much more useful to the organization. Initial failures have provided experience in designing applications appropriate throughout the organization. Data can be shared, but it must be passed manually, either by physical diskette transfer between machines, or by manual file passing in LANs.

d. *Automated Integration Stage*

This stage marks the advent of truly integrated systems. Applications are developed that employ automatic connections among machines of all types throughout the organizations. The need for standards becomes crucial during this period, and they become more stringent. In this stage end-users must still know the physical location of the information to be retrieved.

e. Distributed Integration Stage

By the time this stage is reached, the location of the data to the individual is truly transparent. Desktop, departmental, and corporate level databases are all within reach, depending on security restrictions imposed by the organization. These stages are relatively independent of any particular technology, but are indicative of EUC growth over time in any organization. This continuum is drastically different from the one presented by Alavi, Nelson, and Weiss. Martin et al. *describe* the growth of EUC, but they offer little in the way of proactively affecting EUC in the organization. Huff, Munro and Moore add another aspect to the model which helps to give it a prescriptive quality.

2. Expansion and Control: The Other Dimension

Alavi et al. portray the continuum toward EUC maturity in a fairly linear, one-dimensional fashion. The rate at which the progression is made can speed up or slow down, but, with the exception of the Containment phase, it doesn't progress laterally. Huff, Munro, and Moore add the growth stages described by Alavi, Nelson, and Weiss to the Applications Maturity model to add a second dimension to the EUC growth model. Four strategies are described: Laissez-faire, Acceleration, Controlled Growth (a compilation of Marketing and Operations-based), and Containment (Monopolist). These strategies are used laterally within all Applications maturity stages. Moore et al. suggest that each of these four strategies represents a relative mixture of **control** and **expansion**, the two key ingredients to growth of EUC. Further, every organization will progress in a circular direction through these strategies until they find one that "fits" the needs of that particular Applications maturity stage. At that time the EUC growth will continue on to

the next stage of applications maturity. This presents a model that is far more complex than Alavi, Nelson, and Weiss, but also provides management with far more flexibility in planning. For example, a Containment policy may be inappropriate in certain stages of EUC development, but perfectly appropriate in others.

3. Conclusions

Moore et al. agree with Alavi, Nelson, and Weiss that organizations pass through pre-determined stages on the way to maturity. They indicate that it is management's responsibility to determine the proper mix of expansion and control to optimize each phase. This sounds logical, but is not realistic. Relative mixes of expansion and control are hard to quantify into a plan of action. The best that this model can do for a manager is to give him an idea of what stage he's in, *once the organization is already there*. What is needed is an optimal *strategy* for EUC growth.

F. GERRITY AND ROCKART

Thomas P. Gerrity and John Rockart are high in their praise for the potential of EUC to benefit all aspects of the organization. They do not subscribe to the timetable philosophy developed by the models described above. They look at three strategies that have been discussed earlier not as evolutionary but rather as strategies to avoid at any time in the organization's lifecycle.

They feel that the Monopolist strategy has outlived its usefulness for a number of reasons, including the increased availability (and decreased price) of ADP assets, the lack

of staff members to man large centrally-controlled operations, and the increased ADP literacy of managers and staff professionals outside the ADP departments.

The Laissez-faire strategy has led to the type of uncontrolled acceleration predicted by Alavi, Nelson, and Weiss. Gerrity and Rockart note:

As a result of this approach, almost half of the corporate computer resources at one of the world's largest electronics companies are now being consumed by management and staff who are developing and running Third Era systems. The corporation's posture of letting people "do their own thing" has led to a current forecasted requirement of acquiring an additional large mainframe computer every six months just to support end users. (Gerrity and Rockart, 1986, p.29)

Additional factors arguing against the Laissez-faire strategy are: EUC not aligned with corporate goals, a lack of ongoing support, and the inefficient use of ADP equipment due to lack of standards.

Gerrity and Rockart describe their third strategy as the Information Center approach. This is similar to the Marketing strategy noted earlier in that it attempts to provide a focused managerial approach to end-user computing. (Gerrity and Rockart, 1986, p.29) The IC approach falls short, however, because it does not provide a complete solution to the EUC environment in an organization. ICs focus on **support and control, only two elements** of a successful strategy. The Information Center is an architectural solution to a problem that has not been defined. Defining the problem and dealing with it in an organized fashion are the most important things an organization can do in dealing with EUC. Defining the problem and dealing with it are alternate ways of saying that one

must identify the problem and choose a *strategic direction* to deal with it. To accomplish this, Gerrity and Rockart suggest a new strategy which they call a Managed Free Economy.

The Managed Free Economy seeks to give users the freedom to define, create, and develop their own applications while they adhere to regulations enacted to ensure that their effort is aligned with that of the organization. While Gerrity and Rockart do not do much more to describe this strategy, they continue by defining five key attributes of a strategy that they feel will help steer toward a Managed Free Economy strategy and successful EUC within an organization.

1. Attributes of a Successful EUC Strategy

a. Stated End-user Strategy

In an area with as many different participants as there are in EUC it is vital that all be made aware of the desired direction of EUC in the organization. In a centralized environment technicians may be able to implicitly understand the strategic direction, but in EUC management must make **explicit** mention of the direction EUC is to take.

b. User/IS Partnership

If meaningful contributions are expected from end-users, they must be consulted and made participants in all aspects of the ADP environment. Since they will be expected to develop applications which will help the organization, they should have access to the acquisition process. The IS department within the organization should

actively seek the input of end-users in hardware and software development. Rules and standards should be developed between the two groups. The IS department is and will be a viable entity, but only as long as they remain effective in meeting the needs of EUC.

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c. Targeting Critical Systems and Applications

This attribute expands upon the previous attribute. The process of allowing applications to "bubble up" from the bottom is time-consuming and reactive. An overall strategy must include a commitment to seek out and develop either fledgling applications that hold universal promise, or critical areas that must have applications developed for them. As EUC consumes more and more ADP resources, it must be utilized with care.

d. Integrated Support Organization

Support for end-users is vital to its success in an organization. There have been many methods proposed to provide the necessary support. This support must contain (at least) two key attributes. The support must be dedicated and identifiable, and it must be readily available. Having support "dedicated and identifiable" suggests a central support agency organized with the support role clearly identified in its mission statement. This would prevent the support staff from being drawn off to meet minor problems to the exclusion of helping end-users. To have support readily available suggests a more de-centralized method, where staff members could be assigned to an operational department for assistance. The organization should have **both** of these

support elements present, and should additionally count on a third level of support, the **local expert**. The local expert is the ultimate end-user: a consummate ADP user whose primary role is within the business area of the organization. This local expert can serve as an interface between the technical approach of an ADP professional and the strictly business approach of the end-user.

e. Education throughout the Organization

Support for end-users is critical. Yet, without the establishment of a reasonable knowledge base for end-users to draw from, "support" becomes a euphemism for the IC doing the job. Any technical area requires education, and the need for EUC to be formally presented is especially important. The pace of technological growth in EUC is incredible. It is vital that end-users be taught initially to a reasonable level, and that **appropriate follow-on education be conducted**.

2. Conclusions

Gerrity and Rockart have taken a different approach than the previous authors. The concept of a lifecycle is not presented. Rather, three different strategies are evaluated and discarded in favor of a broad, rather vague, strategy to be embraced. This Managed Free Market strategy is comprised of five critical attributes, which provide a proactive guide to establishing an effective EUC strategy within the organization. The explicit definition of an EUC strategy is vitally important to the ultimate success of EUC within the organization.

G. EUSKE AND DOLK

The final model that will be examined is actually only part of a complete strategy model. The importance of control of EUC to its development within the organization has been pointed out by all of the previous models. Euske and Dolk (1989) have examined control mechanisms for EUC and arrived at conclusions which, while not representative of an overall strategy, provide many factors that should be considered in developing a strategy.

Euske and Dolk have examined the models described above, in addition to the Nolan Stage Model (Nolan, 1977), to arrive at conclusions concerning the nature of existing controls in organizations and the potential for improved means to control EUC. Nolan's Stage Model is one of the best-known models which asserts that EUC maturity within an organization follows a predictable pattern. To evaluate the stage of EUC in an organization, Nolan looked at four areas within the EUC context: data processing (DP) planning and control, DP organization, applications portfolio, and user awareness. By examining these four areas Nolan was able to place an organization within his Stage model. Euske and Dolk adopt these areas to describe three models which they feel represent control alternatives to Nolan and the associated EUC models described above. One minor change that they make is the substitution of Information Center for DP organization.

1. The Bureaucratic Model

Euske and Dolk assert that the Bureaucratic Model underlies Nolan's stage model and its affiliated EUC counterparts. In the Bureaucratic environment explicit

policies and standards are in effect. The overall planning and control is highly centralized. There may be an Information Center, but it is very much like a computer center. The overall focus in the Bureaucratic Model is the efficient monitoring of the end-users. In this model the end-users are not sophisticated, and need to be helped. The logic in this model is that if the end-users obey the rules, the desired outcome will result for the organization.

2. The Norm-based Model

The Norm-based Model is descriptive of a naturally-occurring, transitional state within an organization. It is not an explicit control strategy per se, but rather an observable point along the way for EUC. In the Norm-based Model the explicit, central controls found in the Bureaucratic model are gone. End-users are much more computer literate, and consequently are much more aware of the need to conform to certain rules regarding EUC. The rules, however, are informal and in many cases tacit among the users. If an Information Center exists, the authors indicate that it is much more like a "service center". The end-users likely would come to this IC with a specific, often technical question concerning an application. Since the end-users are more computer literate, it is safe to assume that their applications would be more sophisticated. Euske and Dolk feel that these applications would develop into decision support system (DSS) applications, where they would become much more valuable.

3. Virtual Market

The final model presented for EUC is that of the Virtual Market. In the Virtual Market the EUC organization consists of "power users and local experts". The effect of this high level of user sophistication is that EUC has been incorporated into the overall business strategy. EUC no longer exists as an identifiable entity. The applications have merged into the business itself. Planning, control, standards and policies all concern the performance of EUC vis a vis the organization. This is the highest level of EUC sophistication, and so requires the least amount of overt control.

Euske and Dolk see these models as stages that organizations may see many times throughout the life of EUC in a particular organization. EUC by its nature creates a de facto Norm-based situation. From there the organization can be overtly moved to a Bureaucratic environment, or a gradual shift toward the Virtual Market may occur. The introduction of new, less literate end-users might be enough to "drop" EUC in an organization back to the Norm-based. It is conceivable that if performance lags further then overt controls characteristic of a Bureaucratic strategy might be required.

4. Conclusions

In describing EUC strategies strictly in terms of the control environment observed and desired, the authors pass over the means derived to decide on the particular control environment desired; that is, the strategy. Nevertheless, these three control strategies do much to help understand the relationship of control to EUC within an organization. Of particular importance is the idea that important contributions to the

control of EUC can be made by the end-users themselves. These contribution, in turn, should affect the nature of the strategy directed upon the organization. For example, based upon the maturity of the users and the control environments in place at Marine Corps squadrons, central planners could move to a centralized, standardized environment or a decentralized, ISMO-controlled environment.

H. SUMMARY

This chapter has examined the importance of an overall strategy to the successful development of EUC within an organization. The use of models to assist in evaluating strategies was then presented. Models must be able to describe the environment in which an organization is residing, and they must be able to prescribe the direction for future movement.

Four models were presented which meet the qualifications listed above. In two of the models EUC was presented as a predictable pattern of maturity levels over time. The stages within these models all had important management aspects associated with them that necessitate a pre-determined course of action to optimize them. The third model did not present a lifecycle model but rather examined three historic EUC strategies, each of which were determined to be ineffective. It presented a new "Free Market" strategy. Most importantly, it proposed five key attributes that were essential to a successful EUC strategy. The last model touched only on control of EUC. Three models of control were developed which transcended traditional views of the importance of explicit control measures. Two of the three models called for enforcement of implicit standards by the

end-users themselves. While this paper did not address other aspects of an overall strategy, it nonetheless provides insight into the importance of control to the overall strategy for EUC within an organization.

IV. ANALYSIS AND DISCUSSION OF MARINE CORPS END-USER STRATEGY

A. INTRODUCTION

Earlier chapters have examined general models used to describe EUC. This chapter brings those models together in the context of the Marine Corps' EUC program. The doctrinal EUC planning document for the Marine Corps, the Mid-Range Information Systems Plan, is examined, and the Marine Corps is situated within the EUC models to ascertain the current degree of success of EUC in the Marine Corps aviation arm.

B. DOCTRINAL MARINE CORPS EUC STRATEGY

1. The Mid-Range Information Systems Plan (MRISP)

The Mid-Range Information Systems Plan (MRISP) is presented in an annual Marine Corps Bulletin developed by the Director, Command and Control, Communications and Computer (C4) (MCBul 5271, 1989, p.1-3). The MRISP itself is a seven-year revolving plan which describes the information resource needs, goals, and strategies of the Marine Corps (MCBul 5271, 1989, p.1-3). It is a compendium of information which the Director consolidates from the submissions of various major units within the Marine Corps. The stated purpose of the MRISP is:

To distribute a plan that provides information on the current status and future direction of the use of automatic data processing and data communications technology within the Marine Corps. (MCBul 5271, 1989, Cover Page)

The MRISP has enough information to allow the layman to gain a basic knowledge of Marine Corps organization and the interrelationships which exist between ADP activities and the organizations which they are designed to serve.

2. Overall Strategy

The overall strategy of the Marine Corps is to:

...centralize technical direction, policy formulation, and resource management at HQMC under the Director, C4 Division, while providing data processing support on a regional basis. This management framework fosters uniformity throughout the Marine Corps through standardization of hardware and software to the maximum extent possible while ensuring responsive support. (MCBul 5271, 1989, p.3-7)

This strategy of centralized control and decentralized operations manifests itself within the organization established for EUC in the Marine Corps. As stated above, the Director, C4 Division oversees central control of the Marine Corps ADP environment. Regionally distributed ISMOs, on the other hand, provide support for EUC.

3. Marine Corps Strategic End-User Computing Objectives

Each year the MRISP presents a set of strategic objectives. These objectives ...provide direction to the IRM (Information Resources Management) Program. The developers of the MRISP state four basic assumptions which influenced the selection of the current objectives.

First, functional managers and users will continue to increase their request for the development or enhancement of IS's and other IRM support. Second, IRM personnel will require an increased level of knowledge and technical skills to deal with the increasingly complex computer and data communications environments. Third, functional managers and users will take on a larger role in the design, development, and operation of IS's. Fourth, greater emphasis must be placed on fielding IS's that can be supported while in a deployed or combat environment. (MCBul 5271, 1989, p.4-2)

Based on these four assumptions, eight strategic objectives were identified for action under the current MRISP, two of which concerned EUC: 1) To establish a standardized environment of tools, techniques, and EUC equipment, and 2) To develop strategies to provide training and technical assistance to the end-user (MCBul 5271, 1989, pp.4-6,4-8).

a. Establishing a Standardized Environment of Tools, Techniques, and EUC Equipment

(1) Problem

The MRISP notes the rapid advance of EUC over the past decade and admits that standard policies and guidance have not kept pace. Additionally, a wide variety of different hardware and software tools have been acquired. "This has resulted in a substantial inventory of incompatible equipment and software." (MCBul 5271, 1989, p.4-6)

(2) Strategy

The overall strategy for the solution of this problem has been a strong centralization of the standards for hardware and software management and acquisition (Bass, 1990, p.52). Lieutenant Colonel L. J. Sims, head of ADP acquisitions at Headquarters Marine Corps has noted:

We probably have the best standardization program not only in the Defense Department but probably in the whole federal government. (Bass, 1990, p.52)

The agent for the development of a unified set of EUC standards is a committee called the **End-User Computer/Local Area Network (EUC/LAN) Working Group**. The EUC/LAN Work Group was formally chartered in January 1989 to replace an earlier EUC/LAN Support Program Task Force (ACMC 5000/CS:005, 1989). The new Work Group was established to

...support and assist the Director, C4 Division and the Head, CCI in the development of standards and guidelines for acquiring and managing EUCE and LAN's. (CMC 5230/CCIS-25, 1989)

This group is comprised of representatives of major commands who meet to decide issues relating to EUC standardization (CMC 5230/CCIS-25, 1989). Since the group's inception they have met twice. At the first meeting the Work Group chose a standardized LAN operating system. At the second meeting they selected "Enable", an integrated word processing, spreadsheet, and database management package as a standard Marine Corps software package. (Bass, 1990, p.52)

(3) Status of Effort

According to the MRISP, the objective of **defining** a standard hardware and software environment for EUC within the Marine Corps has been attained (MCBul 5271, 1989, p.4-6). The standards defined through the work of the EUC/LAN Work Group coincided with an effort to standardize technical publications. An additional factor noted by the MRISP that is leading toward a standardized EUC environment is the compatibility of FMF-EUCE with Zenith microcomputers obtained through the Desktop contracts.

b. Providing Training and Technical Assistance to the End-User

(1) Problem

The amount of available training for end-users has not kept pace with the rapid increase in technological breakthroughs in microcomputers. Not only has the Marine Corps acquired a diverse assortment of hardware and software, the situation has been further aggravated by a "...33 percent annual turnover in military personnel and a relatively high turnover in civilian personnel....". (MCBul 5271, 1989, p.4-8) The MRISP notes that without well-educated users, the assets spent on equipment are not truly cost-effective.

(2) Strategy

The MRISP does not provide a strategy to help meet this problem. Rather, it summarizes the results of a study sponsored by the Marine Corps that American Management Systems, Incorporated (AMS) performed in 1986. The major conclusions of the study are:

- (1) Most EUC training is provided locally and there is widespread availability of EUC training.
- (2) Local commands should develop annual training plans for the military and civilian personnel.
- (3) The Director, C4 Division and the Director, Training and Education Center should develop recordkeeping standards to provide an accurate picture of who received training, in what subjects and when in order to minimize duplicate or unnecessary training and to better track training deficiencies.

(4) The Marine Corps should develop an integrated EUC support network under the cognizance of the Director, C4 Division to include: (a) MCCDPA-based mobile training teams and information centers; (b) a Computer Sciences School (CSS) based clearinghouse of EUC materials and programs; (c) CSS developed EUC information letters; (d) CSS provided training in EUC support topics for Occupational Field 40 personnel; (e) a formal interface between C4 Division, CSS, and other formal schools; (f) C4 Division support for local users' groups; and (g) regularly scheduled EUC conferences. (MCBul 5271, 1989, p.4-8)

(3) Status of Effort

The MRISP concludes by noting that the potential strategies described by the AMS are being evaluated for eventual implementation. No timetable is given.

In a slightly different vein, the MRISP addresses the updating of technical publications as another way to help provide assistance in the EUC environment. These technical publications give guidelines and "how-to" information in such basic areas as introductory computer hardware and software concepts and progress through topics including Information Centers, computer security and life cycle management. When completely implemented and universally available, the technical publications will greatly aid end-users. (Pierce, 1989)

4. Summaries of Plan Submissions

The final chapter of the MRISP contains a selection of the ADP problems most cited by commands throughout the Marine Corps. Though these comments are not directly relevant to the stated Marine Corps ADP/EUC strategy, they give a good indication of how the Marine Corps in general feels about the current ADP situation.

The MRISP ranked the ten most frequently stated problems. Of those ten problems, four of them dealt specifically with EUC: (1) the need to establish local and base networks, (2) failure of EUC to meet requirements, (3) lack of EUC hardware and software standards, and (4) the failure of user training to meet requirements. The MRISP posited that the adoption of FMF-EUCE will do much to address the EUC problems stated (MCBul 5271, 1989, p.7-11). Further,

Information centers continue to be implemented to provide users with a central site from which they may obtain training, IRM updates, procurement guidance, programming support, and minor equipment maintenance support...Training for end users has begun throughout the Marine Corps and continues to grow through the further implementation and use of Information Centers. (MCBul 5271, 1989, pp.7-5,7-7)

Finally, concern was expressed by major Fleet Marine Force (FMF) commands:

ISMO T/O's must be increased if the ongoing surge in ADP capabilities is to be maintained and supported (FMF Pacific)...The Marine Corps' first priority for ADP support must be the FMF, not the Supporting Establishment. (FMF Atlantic) (MCBul 5271, 1989, p.7-4)

The following sections examine more closely the issues raised here and the validity of the rebuttals. Whatever the outcome of that examination, however, it is encouraging to note that the two strategic objectives in the MRISP which overtly address EUC are closely aligned with the concerns of Marine Corps users.

Having presented the doctrinal Marine Corps EUC strategy, the Marine aviation squadron is now examined to find where it is placed within the various EUC

models. Placement within the models will determine how well the doctrinal EUC strategy is observed at the squadron level.

C. ALAVI, NELSON, WEISS MODEL

The model developed by Alavi et al. evaluates the organization in three areas: **policy setting and planning, support, and control** to place it in one of five defined strategies. It then describes a series of phases through which organizations pass and prescribes a given strategy for each phase.

1. Marine Corps Policy Setting and Planning

The MRISP delineates ongoing efforts to establish a standard set of policies and guidelines for end-users. Particular emphasis has been placed on standardizing software and hardware for the end-user. This has resulted in the adoption of a Marine Corps de jure standard LAN configuration and a standard integrated software package. However, interviews conducted with three ISC's and an ISMO indicate that the effect of these changes on the aircraft group and squadron appear to be insignificant at this time. (Molen, 1990, Osmer, 1990, Hatton, 1990, Thombs, 1990) The ISMO was aware of the intent of the policies and the extent of the planning, but the ISC's were clearly less informed. For example, none of the Marines interviewed at the group or squadron level were aware of the existence of a Marine Corps EUC/LAN Working Group, a group explicitly chartered to increase efficiency for the end-user.

ISCs interviewed expressed concern that Marine Corps orders governing EUC are too vague to provide meaning to a lower-placed unit such as a squadron. (Molen,

1990) Intermediate level organizations have filled the gap by providing specific guidance to end-users that has not always serve the best interests of the end-users. One of the ISCs cited the example of a directive from such an intermediate level dictating a push toward laptop computers at a time when these computers could not perform applications required in a squadron environment. The ISC interviewed believes that this intermediate level decision was a distortion of a general Marine Corps directive. Because the directive was vague, the laptop move was technically allowable. The end result was a policy which hurt EUC at the squadron level. Major Osmer, the Third Marine Aircraft Wing (MAW) ISMO, did point to the development of the technical publications described earlier as a positive and helpful step in illuminating Marine Corps policies. Unfortunately, none of the lower-echelon interviewees were aware of these publications.

From the point of view of the squadron, then, Marine Corps plans and policies appear to be limited or understated. This perception of limited policy setting and planning is indicative of a *Laissez-faire* strategy. Although in this case the Marine Corps is rapidly developing formal standards and policies for EUC, indicative of a Monopolist strategy, the vehicles for their dissemination and enforcement are not now in place. At the squadron level this is tantamount to not having them at all.

2. Marine Corps EUC Support

The MRISP points to increased EUC support as one of the Marine Corps' strategic objectives. A study sponsored by the Marine Corps points to "pockets of educational support" throughout the Marine Corps, however with "...little coordination among training providers." (MCBul 5271, 1989, p.4-8) These pockets are not distributed

uniformly; not all sites interviewed had **ready access** to training. Major V. J. Thombs, Administrative Officer and ISC for a helicopter squadron at MCAS New River states that there is limited training available for Enable, but the training site is located at MCAS, Cherry Point, some 40 miles away (Thombs, 1990). Training for MAG-39 Marines at Camp Pendleton is provided by the First Force Service Support Group (FSSG), a non-aviation organization at Camp Pendleton (Molen, 1990). This "good neighbor" policy of providing resources across organizational boundaries is admirable, but can't and shouldn't be depended upon. The needs of the providing organization necessarily come first, and when assets become scarce, the providing organization will limit services provided informally. At MCAS Tustin and at MCAS El Toro, training is available in beginning MS-DOS and Enable. Major Osmer developed the program but complains that he is only able to use facilities one week a month, training only twelve Marines per class. (Osmer, 1990)

The available training opportunities for squadron-level users are further degraded by the amount of support available at the group level. The group ISC's interviewed all wanted to help train the users at the squadron, but were seriously understaffed and spent most of their time either reacting to malfunctioning systems or working on the acquisition of new machines for squadrons. (Molen, 1990) The interviewees expressed frustration at the lack of training of many squadron users. It was felt that if squadron users had some basic training in operating systems and machine operation, troubleshooting calls to the group ISC would lessen substantially. (Molen, 1990) The group ISC could then concentrate on acquisition and ongoing training. This

is clearly an ISC's dilemma: he or she spends too much time responding to simple problems which occur as a direct result of little or no introductory computer training. Consequently, time cannot be allocated to provide that training.

The amount of support provided to end-users in the Marine Corps is representative of either a **Laissez-faire** or a **Monopolist** strategy. Both are characterized by little support to the user. In the Laissez-faire strategy essentially no training is provided, while in the Monopolist strategy training is ad hoc and limited to a defined purpose by the controlling authority. That kind of direction at the lower level was not observed in those squadrons and groups interviewed. Support strategy at the squadron level therefore most closely resembles the **Laissez-faire** strategy.

3. Marine Corps Control

The aspect of control within an organization is tightly coupled with the policies and plans of that organization. Control is the means to ensure that the plans and policies are implemented.

It has already been shown that, although plans and policies have been and are being formalized on a continuous basis, they don't seem to be "trickling down" to the group and squadron level.

Control of squadron EUC assets is low for two main reasons. The first is that the Marines in the best position to exert control, the group ISCs, are not sure of the policies to be pursued. An example of this is the recent adoption of Enable as a software standard for the Marine Corps. The Second MAW has directed that all users switch to Enable (Thombs, 1990). On the West Coast, group ISCs at different bases interpreted the

adoption standard in two different ways. One saw it as impending and therefore not yet to be enforced. The other saw it as a directive in place. (Molen, Hatton, 1990) **None of the interviewees**, however, saw a truly effective way to enforce this effort at control.

A method of enforcing controls is to use a "watchdog" approach. This is not currently feasible due to personnel limitations, and is the second reason why control is not effective at the squadron level. The ISCs and ISMOs interviewed agreed that just maintaining the status quo was difficult. (Molen, Hatton, Osmer, 1990) All would like more assets. While this is a common theme in the Marine Corps, the magnitude of the current IS undertaking would seem to indicate a need for additional resources. Lieutenant Colonel L. D. Sims, in speaking of the adoption of Enable, notes that "**...two-thirds of the Marine Corps** (emphasis by author) is going to have to change." (Bass, 1990, p.52)

Control, although portrayed by the MRISP as centralized and strong, is weak by the time it reaches the users at the squadron level. Once again, this situation is descriptive of a Laissez-faire strategy, where there are few controls. The depiction of Marine Corps controls as weak is provocative in an organization that prides itself as authoritarian. There are overt controls in place. As has been shown, this is an ongoing Marine Corps trend, currently being aggressively pursued. The important point here, however, is that if the controls do not reach the squadron, *they may as well not have been applied.*

4. Conclusions

A dichotomy currently exists between what is depicted as the state of EUC by publications such as the MRISP, and what actually exists at the squadron level. This

presents a condition which Alavi et al. do not describe: split strategies within an organization. While Marine Corps policy makers feel that the Marine Corps EUC situation is advanced, a substantial amount of the Marine Corps exists in a Laissez-faire strategy, which is indicative of "...a null phase, or phase 0, due to the relative inactivity along the dimensions of policy and planning, support, and control." (Alavi, Nelson, and Weiss, 1987-88, p.44) The MRISP unwittingly fosters this split when it reports that the Marine Corps favors centralized planning with decentralized operation. The concept sounds good, but somewhere the plans and policies, control, and support developed by the central planners are not reaching the users. The ongoing strategies and phases presented by Alavi et al. are based on the premise that the organization knows which strategy it is employing. For example, from a Laissez-faire strategy the organization **should** move to an Acceleration strategy. If the organizational planners are not in touch with their organization, however, they will not know that this is the prescribed direction to take. This situation does not repudiate the model presented by Alavi et al. It does, however, make the model harder to implement.

D. HUFF, MUNRO, ET AL. MODEL

The model for EUC analysis proposed by Huff, Munro, Martin, and Moore examines EUC applications developed by an organization to place it in one of five stages of growth: Isolation, Standalone, Manual Integration, Automated Integration, or Distributed Integration. Within each stage an organization might find a different EUC strategy appropriate. The strategies discussed closely resemble those of Alavi, Nelson,

and Weiss. Huff, Munro, et al. categorize them as Laissez-faire, Acceleration, Controlled Growth, or Containment. Each represents a different mixture of control and expansion.

1. Marine Corps EUC Applications Maturity

At the squadron level, EUC as represented by in-house developed applications is in the **Isolation Stage**. This stage is characterized by the use of the microcomputer in an "experimental" basis, and connotes little integration into the daily work routine. More important, however, few applications are designed by the user for the enhancement of his work. This is the largest indicator of the fact that the Marine Corps squadron is in the Isolation Stage. The state of user education at the squadron level as described above has resulted in too many users with a woeful lack of computer knowledge. Gunnery Sergeant Molen notes that much of his job consists of making trouble calls for persistent, minor problems such as improper computer or printer switch placement (Molen, 1990). With Marines struggling to become proficient on pre-packaged applications, it is little wonder that extensive EUC development is not occurring.

Even in the more-structured Green Machine environment, applications development is proceeding in halting fashion (Osmer, 1990). Chapter Two highlighted planning efforts in the early eighties to incorporate "Class IV" applications into an overall library of applications. Aday and Pierce, in their thesis on the original IBM 4110 Green Machine, noted that users complained that they didn't have enough knowledge and training to perform Class IV programming (Aday and Pierce, 1982, p.53). Osmer notes that there are efforts being made to compile the same applications library in 1990 as was supposedly available in 1982 (Osmer, 1990). If an aggressively pursued project such as

the Green Machine has made so little progress, what will happen with the myriad of microcomputers procured under the Desktop contracts?

The Marine Corps hopes to increase the interconnectivity of its microcomputer assets by incorporation of LANs to the squadron level (Osmer, 1990). The adoption of a standard network operating environment by the EUC/LAN Working Group has helped to lay some of the groundwork for this project. The Third MAW is currently working aggressively to this end. Already LANs are in place down to the group level. (Osmer, 1990, Hatton, 1990, Molen, 1990) By linking all aviation assets via interconnected LANs, a much higher degree of interconnectivity is possible. If successful, this network system will move the Marine Corps into the Manual Integration Stage or even higher, since information will be able to be passed via the network. With the benefits of such a network apparent, it is logical to assume that more emphasis would be placed upon becoming proficient. In short, there would be real incentive to learn the system and use it.

There are mixed emotions about the incorporation of such a system. Major D. R. Dempster, ISMO for the Second MAW in MCAS Cherry Point, notes that there will be a tremendous savings in equipment costs by sharing servers and other peripheral equipment with other local units (Dempster, 1989). On the West Coast Osmer feels a great deal of apprehension about allowing users with the minimal knowledge of some Marine users on a network. In an Isolation environment the potential for hurting one's own machine and/or data is real, but contained. The danger to corporate data becomes significant when under-educated users are placed on a network. Security measures are

available, but the "read-only" measures that protect data also prohibit effective retrieval and editing, and consequently diminish the benefits of the prospective network. The local network administrators would be drawn from the Group ISC ranks, many of whom have little or no experience in such a role (Hatton, 1990). Molen is against the concept of linking squadron computers at this time. Aside from the real training problem, he is still facing a compatibility problem with his group's machines that must be resolved before they can even be incorporated into a network. Many Zenith Z-120s still exist in his group, which are not compatible with the later Z-248s. He is faced with pulling these Z-120s for the sake of standardization with no available replacements. (Molen, 1990) One step forward in this case may require quite a few back first.

2. Marine Corps EUC Strategy

As has been demonstrated in the earlier model, a dichotomy exists between the strategy implemented at the squadron level and that dictated at Headquarters, Marine Corps level. The ramifications of that split are more extreme in the Huff, Munro, et al model.

Headquarters, Marine Corps, by emphasizing rigid standards and explicit controls, manifests a Monopolist strategy. This is done with the express purpose of "pushing" Marine Corps users into higher levels of competence, and in this model, into interconnectivity and applications maturity. To that end, networks are being planned and will be implemented. A mistake is being made however, if the assumption is that the establishment of the system hardware is the hardest part of the initiative. Once the system is in place it must be used, and used effectively. To do this, Marines must know

what to do. If many cannot even use a computer effectively now, how will they fare in a network environment? While it is true that the establishment of a network is a major task that must be addressed, the education of the personnel to use and administer that network effectively is a far more extensive task. Huff, Munro, et al. suggest that each stage of connectivity will be attained by the use of a particular strategy. As in the earlier model, they assume that everyone in the organization is aware of the situation within the organization.

3. Conclusions

Once again, the Marine Corps central planners appear to assume too much expertise on the part of the users. The potential ramifications of this misunderstanding are more extreme in the environment of interconnected microcomputers. Additionally, while there has been a great deal of emphasis placed upon the adoption of a network, there is little emphasis placed upon an environment that will encourage development of applications suitable for the network. Little knowledge exists now for applications development. What will happen when a network, with its learning time, is added to a new software standard? The disjointed education and support environment now in place is ill-prepared to meet this challenge.

While central planners are correct in wanting to move the Marine Corps forward into more advanced stages of interconnection, issuing dictates is but the first step. After that the ways to accomplish the dictates must be put in place. Education, support, guidance; all are crucial to the success of the venture.

E. GERRITY AND ROCKART MODEL

Gerrity and Rockart point to strategies such as Laissez-faire, Monopolist, and Information Center (similar to Marketing) as having outlived their usefulness. They suggest a Managed Free Economy as the end toward which to work. This strategy consists of five key attributes: **a stated end-user strategy, user/IS partnership, targeting critical systems and applications, integrated support organizations, and an emphasis on education throughout the organization.**

1. Stated End-user Strategy

A stated strategy helps those, particularly at the lower levels, "look beyond the trees" and get a feeling for why a direction is being taken and how to take it. One of the biggest complaints of those at the lower levels is a lack of this stated direction. (Molen, 1990) While many see the advantages of ADP support for the squadron (Thombs, 1990), there is a "disconnect" between the strides being taken from above (e.g., standardizing software) and the actual needs of the lower-level units (e.g., hardware support, software and basic machine training, etc.)

2. User/IS Partnership

Explicit in the concept of a User/IS partnership is the notion that users should help develop the tools that will make them more productive. This could include the choice of machines and software, as well as joint development of standards designed to form a framework for effective utilization of those devices.

The Marine Corps appears to have made a commitment to this end when they adopted an EUC/LAN Working Group comprised of representatives from organizational units throughout the Marine Corps. Further, when agenda topics were chosen, active effort was made to gather data from the FMF at large for discussion at meetings. A prime example of this was the dissemination of a message throughout the Marine Corps seeking an inventory of software used in the lowest levels of the Marine Corps prior to evaluating alternatives for a standard software package. (CMC/CCIR 210033Z JUL 89)

ISCs interviewed, however, had not heard of the Working Group. Although they had participated in the Corps-wide software inventory they stated that they were not aware of its purpose. (Molen, 1990, Hatton, 1990) A group chartered to help users would be a powerful public relations mechanism in and of itself. It seems curious that this Working Group is not more widely known, at least among ISCs. A more troubling aspect of the Group is its constituency. Major Osmer made the following personal notes after the EUC/LAN Working Group had met to determine a software standard:

The original EUC/LAN working Group charter had proposed that 14 FMF commands (3 MEFs, 3 DIVs, 3 FSSGs, 3 MAWs, FMFPac and FMFLant), 3 Reserve commands, and 15 Supporting Establishment (SE) commands (HQMC, MCCDC, 2 MCRDs, 2 COMCABs, 3 MCCDPAs, and 6 MCBs) could vote. However, when the charter was signed by BGen McKay, only 5 FMF commands (3 MEFs, FMFPac and FMFLant), 1 Reserve command, and 10 SE commands (HQMC, MCRDAC, 3 MCCDPAs, and 3 MCBs) could vote. It is my opinion, FMF commands will eventually suffer on future standardization efforts. (Osmer (A), 1989)

It is highly unlikely that a professional ADP Marine in a mainframe-oriented Support Establishment would be able to understand and empathize with the problems of an FMF unit at the squadron level. Moreover, the charter of the Working Group is clear: each

representative is to present and voice the concerns *of the organization to which he or she belongs*. This shift away from the concerns of the FMF is difficult to understand, and appears to proceed counter to the spirit of the Working Group charter. It certainly does not develop the concept of a team effort between IS and the user from the FMF point of view.

3. Targeting Critical Systems and Applications

A proactive strategy to help users identify critical systems and aid in their development is one of the more pronounced examples of a User/IS team. The Marine Corps is endeavoring to develop systems to help the user. Probably the best example of this is the adoption and incorporation of networks throughout the Marine Corps to facilitate reporting requirements. As has been mentioned earlier, however, the effort is system-oriented, with end-user support and education having a relatively low priority in the development process. While there are plans in place to provide administration for the networks, the lack of computer knowledge at the squadron level to handle such a system is causing consternation for ISCs and ISMOs (Molen, 1990, Osmer, 1990). While a concerted effort to develop applications has not been documented, the pressure for the formation of applications libraries for Green Machine applications has been renewed (Osmer, 1990).

4. Integrated Support Organization

The ISMO and ISC were created to help facilitate the incorporation of the Green Machine into the Marine Corps. They have remained during the initiation of

microcomputer use and are now an integral part of the support for the end-user. The number of ISMO Marines has, in some cases, increased to help provide support. ISMOs and ISCs interviewed do not feel that they are adequately staffed to meet the needs of education, support, control, and administration. (Molen, 1990, Osmer, 1990) Further, the ISCs at group and in the squadrons do not generally receive any formal training prior to their accession as the local ADP expert. (Osmer, 1990)

5. Education Throughout the Organization

The theme of user education has surfaced consistently throughout this thesis, and looms as a very large problem. Headquarters, Marine Corps feels strongly enough about this problem that it has identified the development of training strategies as a strategic objective, and has sponsored a related study. The adoption of standard software will help ease the problem, but learning the system initially, receiving support, and training replacements requires an ongoing training program.

6. Conclusions

The Marine Corps has taken great strides toward the adoption of many of the attributes which Gerrity and Rockart feel are important. Many of the directions, however, are chosen from the standpoint of the central, non-FMF unit. This divorce from the FMF end-user helps perpetuate the myth that the end-user is computer-literate, well-supported

and is aligned with corporate information policies. In order to satisfy the five attributes described by Gerrity and Rockart, the perceptions of the users must be used as the ultimate gauge of success.

F. EUSKE AND DOLK MODEL

Euske and Dolk assert that control of information resources within an organization is characteristically bureaucratically-imposed. Given a computer-literate user base, this situation can migrate either to a condition where unspoken norms govern the EUC actions of the users, or ultimately to a state where EUC controls are blended seamlessly into the organization itself.

One of their central themes is the notion that users can control their own use of EUC. In a rapidly-changing environment, bureaucratic controls over a large organization with few controlling agents is bound to be ineffective. Unfortunately, the alternatives that Euske and Dolk present stand little chance of being adopted, largely because of the inexperience among the user base in general. What is left, then, is overt, bureaucratically-imposed guidelines. The Marine Corps operates primarily in a bureaucratic mode, and most likely will stay there for quite some time to come.

G. SUMMARY

This chapter has examined EUC in the Marine Corps from the perspective of four models. In the Alavi, Nelson, et al. model conditions at the squadron level are indicative of a **Laissez-faire Strategy**. Although explicit standards and controls are being developed, little changes have occurred for Marines at relatively low levels within the

Marine Corps. This analysis revealed a dichotomy in Marine Corps EUC management. Central authorities appear to favor a strong, **Monopolist Strategy**, but the low level users do not feel its effect. A split was observed in the Huff, Munro, et al. model as well. Although the squadron-level Marines appeared to be in the **Isolation Stage** of their model, central authorities are seeking to provide the impetus to move to greater levels of interconnectivity by the imposition of a Marine Corps-wide series of networks. Although these networks may ultimately benefit all, **central authorities do not foresee the danger of an under-educated user population in a sophisticated network system**. The Marine Corps shows strong positive growth in the five attributes which Gerrity and Rockart feel are critical to successful EUC strategy. In this model as well, however, decisions crucial to the development of lower level users are being made without the input of the users themselves. Means to derive this input, such as the **EUC/LAN Working Group**, are focusing on higher-level, Supporting Establishment agenda, to the possible detriment of squadron-level, FMF Marines.

V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

The questions that guided the research effort of this thesis are again listed here in conjunction with the conclusions drawn during the course of the study. Specific recommendations for the Marine Corps are presented, and areas for future research are suggested.

B. RESEARCH QUESTIONS

- What is the stated strategy for end-user computing development within the Marine Corps?
- Does the Marine Corps' main information resource management planning document (the Mid-Range Information Systems Plan) accurately depict the current EUC situation at the small unit level?
- Does the current Marine Corps EUC strategy provide for effective growth at the small unit level?
- How do current EUC conditions at the small unit level in the Marine Corps compare to models found in the literature?
- Is the current EUC organizational structure within the Marine Corps adequate to meet the needs of users throughout the Marine Corps?
- How are end-users at the small unit level trained and supported?

- How can users be better trained?
- What changes should be made in strategy (and) structure to facilitate effective EUC utilization in the Marine Corps?

C. CONCLUSIONS

1. Marine Corps EUC Strategy

The strategy that the Marine Corps has developed for EUC use is the same type of strategy that it has successfully used in the mainframe environment and with the ADPE-FMF. This "centralized policy making combined with decentralized operations" approach has resulted in some success in the EUC area, chiefly in the acquisition of hardware and software products for squadron users.

The real issue is whether the Marine Corps' strategy has *fostered and encouraged growth* of EUC in the Marine Corps. Based upon interviews with squadron and group-level Marines, it appears that little progress is being made, or at least the progress being made is not at a rate commensurate with the acquisition rate of EUC machinery.

The EUC models examined in this thesis all emphasized the need for an explicit EUC strategy which the users know and understand. Analysis of the Marine Corps within these models revealed a split between the perception enunciated by central Marine Corps authorities and that at the squadron end-user level. This split has occurred because the central planners do not have enough input from the low-level users. Consequently the plans and policies are either unacceptable or unintelligible to the users.

The dichotomy between the strategic state of the low-level EUC population and Marine Corps central planners is one of the two biggest problems facing EUC in the Marine Corps. Because of this problem, many opportunities available in a highly proactive Marine Corps environment are not being realized to their fullest potential. The most immediate example is the work of the EUC/LAN Working Group. This committee is doing a significant amount of constructive work. The lack of adequate representation by the FMF in this Group is a serious flaw, and may cause poor decisions in the future.

2. Training

There is a significant problem with EUC training at the squadron level in the Marine Corps. This is partially caused by the decentralization of all functions, including education, to the lowest levels. Wing ISMOs are aware of the problem and are dealing with it. They do not have the resources available to provide useful and comprehensive training to their geographically-distributed areas of responsibility. The result has been a reliance on the ISC to come up with a plan of his own. While the group ISCs interviewed have recognized the problem and have found a method of training, this catch-as-catch-can approach is far too reliant on the individual personality. When the individuals themselves are not trained ADP professionals, this approach is extremely risky.

There is no quantifiable evidence that the lack of training and the subsequent low ADP education level of squadron Marines has hindered growth. Based on the individuals interviewed, however, a cause and effect relationship is believed to exist.

A larger problem than the relatively slow acceptance of EUC looms in the future if plans for sophisticated interlinked networks continue with the state of user education at its present level. Users do not currently know enough to use the proposed system effeciently, nor are they aware of the vast benefits it can bring. This situation is the worst consequence of a central planning organization out of touch with its users.

3. Organizational Aspects

The central planning structure within Headquarters, Marine Corps has taken a great interest in the development of EUC in the Marine Corps, and has provided outstanding service in areas identified as needing attention. The establishment of software standards, the establishment of an EUC work group and the need for acquisition streamlining procedures serve as examples of an efficient, beneficial organization. ISMOs and ISCs theoretically provide for a two-way flow of information with the end-user. There is a breakdown, however, at the lower levels. This is primarily because of the number of available staff and the staff's lack of ADP background. If one is going to employ a decentralized operations policy, appropriately staffed and trained organizations must be fielded to perform those decentralized operations. This is currently not the case in the Marine Corps. As long as this condition exists, problems associated with the discrepancy between technology and the end-user knowledge base will continue to develop and multiply.

4. The Mid-Range Information Systems Plan

The MRISP is both a plan and a historical document. It should tell central authorities what the users feel are pressing matters while it enunciates to the users how those matters will be incorporated into an overall strategy. The document reviewed in this thesis contains all of the information but it is, in certain cases regarding EUC, contradictory. The lack of a global training and education strategy is noted as an objective that has not been achieved, but the adoption of Corps-wide Information Centers is inferred later in the document. A small but significant portion of the document publishes comments from Marine Corps units. Submissions from both major FMF commands remind the reader of the primacy of FMF operations in the Marine Corps. The fact that these statements are made overtly casts doubt on the universal acceptance of EUC implied in the MRISP, and tend to corroborate the fears of Major Osmer regarding FMF representation in the EUC/LAN Work Group.

D. RECOMMENDATIONS

1. Emphasize EUC Education and Support

The Marine Corps is doing much work to provide adequate standards and policies to the end-user. Unfortunately, the means for emplacing and enforcing those standards and policies are not in place. The best way to ensure the use of a particular standard is to *provide support for it*. This will ensure compliance to standards while it develops EUC as a whole.

The AMS study provided a complete list of potential training strategies. The important next step is to implement them. Much is made of the decreased training required because of software standards. However, little has been said to date of the training required to establish the knowledge base, nor of the necessity to fill the gaps caused by normal and unplanned attrition, both civilian and Marine.

2. Implement Information Centers At All Bases

The implementation of ICs across the Marine Corps is the best way to accomplish the very two objectives which the MRISP has identified of enforcing standardized practices and providing education. By providing training to ISCs to run the IC, central planners are ensuring that the message which they want to send is being received *at the lowest level*. A further benefit is the real link between planners and users.

There will definitely need to be an increase in resources to implement these ICs. The largest resource increase will be the Marines to run the ICs. ISCs are clearly too busy to run them entirely on their own. They will need help, particularly at the beginning. However, after the ICs establish a baseline for user knowledge, the ISC should become less encumbered by his present troubleshooting calls. Adequate classroom facilities exist at most bases, although shortages undoubtedly will occur. The Marine Corps must realize, however, that resources will be needed to support EUC.

3. Evaluate Central/Distributed Responsibilities

It has been shown that there is an important, legitimate requirement for central guidance in plotting EUC direction and ensuring its success. In the Marine Corps, the division of responsibilities has, in certain cases, hindered efforts to enhance EUC.

A central planning effort is required to adequately utilize the disparate means available for training. Universities, trade schools and different organizations are available at local levels to aid in the training. Each geographical area will have different means to use the training environments, based upon availability. It is crucial that central assistance be provided to optimize these local resources for the training and support of Marine users. Once the plan is in place, local ISCs can implement it.

To ensure that these responsibilities are being met, both by central authorities and local users, adequate lines of communication must be developed and utilized. The Marine Corps has such lines constructed as witnessed by the MRISP, the ISC-ISMO offices, and the formation of the EUC/LAN Working Group. The importance of two-way communication must be emphasized to ensure that there is a proper delegation and assumption of authority.

4. Emphasize the Information Systems Coordinator

It is assumed that in the foreseeable future constraints on the number of professional ADP specialists available will prohibit their large scale integration into the FMF. Barring this, there must be trained Marines available for consultation and training. ISCs are ideal for this role. In order to properly exercise their responsibilities, however,

they must be suitably prepared to assume the job. ISCs at the group level at a minimum must receive formal training, preferably at the Computer Sciences School at Quantico, Virginia.

E. AREAS FOR FURTHER RESEARCH

During the course of this study it became apparent that the Marine Corps is in a state of transition regarding its treatment of EUC. The objectives of the MRISP and the establishment of the EUC/LAN Work Group point to a need for change. Also, just from a cursory look at the state of EUC in the FMF it is apparent that there is a great deal of disparity in the state of maturity in different organizations. The following recommended topics follow generally from these two observations.

- Describe and evaluate plans for comprehensive EUC education plans in the Marine Corps.
- Perform a survey of EUC maturity across different combat specialties (e.g., air versus ground, etc.)
- Perform a survey of EUC maturity across different organizational strata within the same combat specialty (e.g., squadron versus wing levels)

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